Temperature Distribution of an Improved Cook Stove

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ABSTRACT

The objective of this experiment is to determine where heat is lost in a manufactured cook stove. By using thermocouples interfaced with a computer we were able to measure the temperature distribution on different surfaces of a cook stove designed for use in developing nations. By comparing the temperature of the top surface to the remaining sides and chimney, with relationship to the mass of the fuel consumed we were able to determine the fuel efficiency of the stove.

BACKGROUND

Cook stoves burning wood or other biomass are used by nearly 2 billion people throughout the world, most commonly in developing nations.

The traditional stoves in these countries are inefficient, requiring a large amount of wood mass to heat the surface for cooking. There also are many health concerns such as severe burns, respiratory illness, and blindness. In addition, the large fuel consumption has lead to deforestation in many parts of the world.

The Ecofogão stove was designed for use in Brazil to address these concerns of fuel efficiency and safety.

RESEARCH QUESTION/HYPOTHESIS

To determine the heat efficiency of a cook stove.

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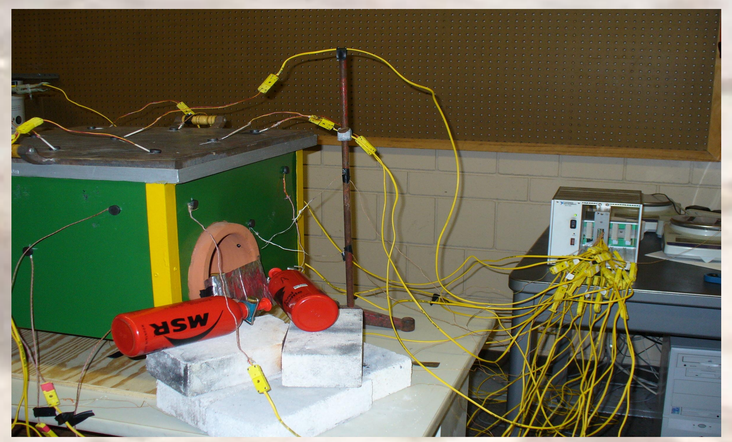
METHODS

After determining the locations of interest, thirty thermocouples were placed on six different surfaces and the chimney of an Ecofogão Stove. One additional probe was used to measure the ambient temperature in the room. Two single burner camp stoves using white gas as a fuel were placed in the combustion chamber and ignited to allow the stove to increase in temperature. Before lighting the burners, the mass of each bottle of fuel was determined. While the burners were lit, each bottle was pumped every five minutes. The surface temperatures from each probe were collected every ten seconds while the burners were lit and for several hours after the burners were shut off. A final mass of the fuel bottles were measured to determine the mass of fuel consumed.



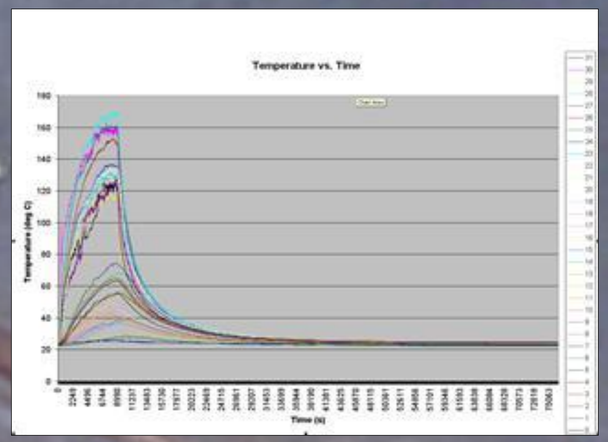


Figure 1: Temperature Time Graph for Specific Stove Surfaces

RESULTS

The temperatures of the surfaces were graphed by the computer as shown in Figure 1. Finally, the amount of heat lost from each surface area was calculated. This calculation excludes the heat loss from the chimney and the combustion chamber. The top surface was determined to have the highest percentage of energy flow at 52%. The surface reached a temperature as high as 170 degrees Celsius while the sides and bottom only reached a maximum temperature of 75 degrees.

DISCUSSION

The Ecofogão Stove was designed to improve the heat efficiency of burning wood by channeling more heat to the surface and less to the sides and bottom of the stove. In addition, by reducing the temperature of the remaining sides, the safety of the stove was much improved. A painted surface at 64 degrees Celsius could have human contact for 4 seconds before causing burns. Nearly every non-cooking surface stayed below or close to this temperature.

REFERENCES

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